

MTU engine surpasses 20,000-hour mark hauling coal at Canada's largest mine



Who: Highvale Mine, operated by Prairie Mines & Royalty Ltd.

What: MTU 20-cylinder Series 4000 engine in large-haul trucks capable of carrying 400-ton loads

Why: To meet the challenges of hauling overburden loads in extreme conditions by relying on robust engine design and long engine life due to scrupulous maintenance

Where: Edmonton, Alberta, Canada



Attention to recommended maintenance and fuel quality lengthens engine life and reduces costly equipment downtime.

Located about 40 miles west of Edmonton, the Highvale Mine is the largest surface coal mine in Canada, covering almost 30,000 acres (120 km²) and yielding roughly 12 million tons of low-sulfur-content, thermal-grade coal each year.

Vital to the success of this large operation are large haul trucks powered by MTU engines. Recently, one of these MTU engines gained notoriety when it far exceeded the most optimistic lifespan projections by thousands of hours, due to robust engine design and disciplined adherence to the manufacturer's maintenance and fuel-quality recommendations.

Highvale is one of three surface coal mines owned by TransAlta, a company that operates power plants in Canada, the U.S. and Australia. Alberta-based Prairie Mines & Royalty Ltd. (PMRL) operates the mine and supplies Highvale coal to three TransAlta plants.

In surface coal mining, the coal seam is exposed by removing layers of overburden. Large shovels load tons of pre-strip overburden into huge haul trucks. At Highvale, the hauling fleet consists of 10 trucks, including six Liebherr T 282 B diesel electric trucks capable of carrying 400-ton loads.

Jim Richter, maintenance planner, PMRL Highvale Mine

“Minimizing downtime is more important than anything. We have a fairly small fleet, so truck availability needs to be very high.”



Power. Passion. Partnership.



The engines in Highvale's Liebherr trucks are 20-cylinder Series 4000 models that provide 3,650 hp for hauling heavy overburden loads. One of these engines was replaced after a notable four-year run during which it logged over 23,000 service hours, exceeding the engine's maximum expected life by more than 3,000 hours.

Besides hauling heavy loads, the trucks often operate in extreme cold. In the wintertime, temperatures at the mine sometimes drop to -40 degrees C (-40 degrees F), according to Jim Richter, PMRL's truck maintenance planner at Highvale.

To meet the considerable challenges posed by operations like this one, Highvale's Liebherr trucks are equipped with MTU Series 4000 diesel engines. These engines, which are used in several different brands of mine trucks in 12-, 16- or 20-cylinder configurations, to date have logged approximately three million hours in mining applications. Today, more than 300 Series 4000 engines are installed in Liebherr trucks and working at about a dozen mine sites around the world, according to Adam Matlock, senior service engineer for MTU engines at Tognum America.

Engine's long run exceeds expectations

The engines in Highvale's Liebherr trucks are 20-cylinder Series 4000 models that provide 3,650 hp for hauling heavy overburden loads. In late 2011, one of these engines was replaced after a notable four-year run during which it logged over 23,000 service hours, exceeding the engine's maximum expected life by more than 3,000 hours.

The engine has been sent to Wajax Power Systems in Edmonton, the local MTU servicing distributor, where it will be overhauled for reuse. At Highvale, the haul truck that housed the engine is back on the job, powered by a spare engine kept by PMRL to minimize downtime caused by engine replacements. The engine now being overhauled will serve as the spare when work on it is completed.

At Highvale, long engine life is crucial because the engine overhaul has a high impact on truck operating cost. Equally important, high reliability of the engine reduces vehicle downtime, which can cost the mine tens of thousands of dollars a day in lost revenue. "Minimizing downtime is more important than anything," said Richter. "We have a fairly small fleet, so truck availability needs to be very high."

Maintenance plays key role

Why did this particular engine last so long? In large part, Richter attributes it to good maintenance practices. PMRL personnel follow MTU maintenance recommendations closely and try to see to it that maintenance is performed within 50 hours of when MTU published guidelines call for it.

When it comes to recommended maintenance, MTU has a different approach than some of its competitors. "We're a little more aggressive in our maintenance practices," said Matlock. "We don't believe in running components until they break. Our philosophy is to proactively replace components before they reach the end of their life expectancy."

Matlock points to two main reasons for this approach. For one thing, it results in scheduled downtime rather than unscheduled downtime, boosting the production of a mine or any other business. In addition, the practice of replacing components before they break eliminates the possibility that broken components will do further damage to the engine or other components. "If a turbocharger breaks, for example, metal debris traveling through the system could cause a catastrophic failure of the entire engine," he said.

At Highvale, key items on the engine maintenance schedule include the following:

- *Oil changes.* These are done approximately every 500 hours using 15W-40 oil. In determining when to perform oil changes and other maintenance, PMRL goes by normally operated hours (NOH), the number of hours operators actually drive the trucks, rather than the number of hours logged by service meters in the trucks. This results in longer intervals between service than intervals based on Service Meter Unit (or SMU) hours.
- *Valve adjustments.* Engine valves are inspected and adjusted every 3,000 hours.
- *Fuel injector change-outs.* At Highvale, these change-outs used to be done at 6,000-hour intervals. But the injectors in the 23,000-hour engine were replaced just once. The reason: "When we did the first injector change-out, we found that the injectors were in pretty good shape," Richter said.

Ran Archer, sales manager for MTU mining engines, Tognum America

"If you're careful about [using clean fuel and performing recommended maintenance], MTU engines will run a long time and help drive down operating cost."



Power. Passion. Partnership.



Highvale's Liebherr trucks have logged approximately three million hours in mining applications. Good engine maintenance practices increase reliability and reduce vehicle downtime. Downtime can cost the mine tens of thousands of dollars a day in lost revenue.

- **Midlife service.** As with valve adjustments and injector change-outs, Highvale calls on Wajax to handle this service, which is done around the midpoint of an engine's life. It's an important undertaking that includes checking and/or replacing many components, including the water pump, thermostat, grounding device, fan belt, drive system, vibration dampener, intercooler and turbochargers. While some large-truck engines have as many as eight turbochargers, the Series 4000 has just two in the large 20V configuration, making it easier to service the engine.

Paying attention to fuel

Besides performing routine maintenance according to schedule, owners of Series 4000 engines should pay attention to fuel quality, according to Ran Archer, sales manager for MTU mining engines at Tognum America. Specifically, engine owners should try to minimize any contamination in the fuel and make sure the fuel complies with specified lubricity requirements to facilitate the motion of components such as injectors.

Highvale's haulage fleet is operated on high-quality fuel, said Richter, who believes this was a key to prolonging the life of his 23,000-hour engine. In addition, Highvale tries to improve fuel cleanliness using systems that filter fuel as it's transferred from delivery trucks into fuel tanks at the mine.

The result: "We don't have any fuel issues with any of the equipment we have here," Richter said, adding that he's heard reports of injector-failure problems at other mines. When injectors fail, he explains, the result is uneven fuel distribution in the cylinder, which causes hot spots that can burn out pistons and dry out cylinder walls – and ultimately cause engine failure.

Based on the results at Highvale, it appears that strict adherence to such practices as using good, clean fuel and performing recommended maintenance on schedule can yield extraordinary results when it comes to engine longevity. "If you're careful about things like that," said Archer, "MTU engines will run a long time and help drive down operating cost."

MTU America Inc.

A Rolls-Royce Power Systems Company

www.mtu-online.com

MTU is a brand of Rolls-Royce Power Systems AG. MTU high-speed engines and propulsion systems provide power for marine, rail, power generation, oil and gas, agriculture, mining, construction and industrial, and defense applications. The portfolio is comprised of diesel engines with up to 10,000 kilowatts (kW) power output, gas engines up to 2,150 kW and gas turbines up to 35,320 kW. MTU also offers customized electronic monitoring and control systems for its engines and propulsion systems.



Power. Passion. Partnership.